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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/180,629	11/12/1999	Aaron Fenster	204694.00037	7008

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EXAMINER	
SUKHAPHADHANA, CHRISTOPHER T	

ART UNIT	PAPER NUMBER
2625	

DATE MAILED: 05/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/180,629	FENSTER ET AL.	
	Examiner	Art Unit	
	Christopher T. Sukhaphadhana	2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 March 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Request for Continued Examination

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's Request for Reconsideration filed on 28 October 2003 has been entered.

Drawings

2. Corrected drawings are required in this application because proper corrected drawings have not been filed in response to paragraph 5 of the Office Action filed 07 May 2003. See also the approved *proposed* corrected drawings filed 07 March 2003 and paragraphs 1-3 of the Office Action filed 20 September 2002. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

Response to Amendment

3. The Amendment filed 19 March 2004 has been entered in full.

Response to Arguments

4. Applicant's arguments with respect to the prior art rejection of claims 1-13 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. **Claims 1, 3, and 13** are rejected under 35 U.S.C. 103(a) as being unpatentable over Quistgaard (U.S. Patent 5,485,842, previously of record, "Quistgaard") in combination with Vining (U.S. Patent 5,782,762, newly cited, "Vining").

7. In regards to **claim 1**, Quistgaard discloses a three-dimensional imaging system comprising a scanning means (ref no 10, Fig 1) to scan the target volume using an angular scanning technique (col 4, line 5), and generate a succession of two-dimensional images representing cross-sections of the target volume on a plurality of planes spaced around an axis of rotation of the scanning means (col 4, line 15); a memory means (ref no 34, Fig 1) storing the succession of digitized two-dimensional images (1', 2', 3' in Fig. 5a-d) and a data set comprising parameters defining the geometric (col 4, lines 59-63) and orientational (col 7, lines 60-63) relationship between successive digitized images; and a transformational means for receiving the digitized two-dimensional images and the data set (ref no 32), and a transformation means responsive to user selection of a three-dimensional image surface to be displayed (col 8, lines 21-44), the transformation means receiving the digitized two-dimensional images and the data set

(ref no 32, Fig 1), and transforming image data within the received two-dimensional images that is necessary to view the selected three-dimensional image surface (col 8, lines 28-32).

Quistgaard does not expressly disclose transforming only a portion of the image data, wherein the portion that is transformed is less than all of the image data within the received two-dimensional images.

Vining teaches in col 11, lines 1-24, "Sample Crop", transforming only a portion of the image data, wherein the portion that is transformed is less than all of the image data within the received two-dimensional images.

Quistgaard and Vining are combinable because they are both in the field of 3D medical imaging.

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine Vining's teachings into Quistgaard's system.

The suggestion/motivation for doing so would have been to further reduce the volume of the dataset (Vining, col 11, line 10).

Therefore, it would have been obvious to combine Quistgaard and Vining to obtain the invention as specified in claim 1.

8. In regards to **claim 3**, Quistgaard further discloses the angular scanning technique as a fan scanning technique (col 4, line 5).

9. In regards to **claim 13**, most of the elements set forth in this claim have been addressed in the argument of claim 1.

The additional limitation that the portion of the image data transformed is data representing an edge of the target volume is further taught by Vining because data representing

an edge of the target volume is inherently included in the subcropped or subsampled data (col 11, line 8).

10. **Claims 2 and 5** are rejected under 35 U.S.C. 103(a) as being unpatentable over Quistgaard and Vining as applied to claim 1 above, in combination with Fenster et al (U.S. Patent 5,454,371).

11. In regards to **claim 2**, Quistgaard and Vining do not specifically disclose the angular scanning technique as an axial scanning technique.

Fenster '371 teaches the use of an axial scanning technique (Fig. 4) for use in a three-dimensional imaging system similar to Quistgaard.

The ultrasonic probe (10) of Quistgaard would undergo the motion of Fenster's probe (24) indicated by arrow 48 to achieve the desired scanning technique.

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine Fenster's axial scanning technique with Quistgaard's probe because the utilization of this scanning technique would be effective for scanning organs of a subject under examination, such as the eye or prostate (Fenster '371, col 5, lines 35-38).

12. In regards to **claim 5**, Quistgaard and Vining do not specifically disclose storing data defining the degree of out-of-plane tilt of the transducer, the degree of out-of-plane displacement, nor the degree of in-plane tilt.

Fenster '371 teaches of using said data (col 8, lines 24-52) to compensate for inaccuracies in the final reconstructed three-dimensional image (col 8, lines 63-65). Once said data were known, it would have been obvious to one of ordinary skill in the art at the time of the invention

to store said data because they are constant for any set of image lines of an image array to be reconstructed (col 10, lines 23-38) and can be reused for such reconstruction without unnecessary recalculation.

13. **Claims 4, 9, and 10** are rejected under 35 U.S.C. 103(a) as being unpatentable over Quistgaard and Vining as applied to claim 1 above, and further in view of Fenster et al (U.S. Patent 5,842,473) and Hossack et al (U.S. Patent 6,360,027).

14. In regards to **claim 4**, Quistgaard additionally discloses the storage of the total angle of acquisition (col 6, lines 35-54). Quistgaard anticipates the storage of a 90deg sector image (col 6, line 40). This storage of this value is necessary to estimate the amount of physical space the image represents as shown in Figure 3, and this value can be used to keep track of virtual viewpoint changes as shown in col 5, lines 20-43.

Quistgaard further discloses the storage of the total number of acquired images (col 4, lines 19-23). Quistgaard anticipates the typical storage of 100 to 200 images (col 6, line 20). A data structure used to store images commonly employed and known to one skilled in the art is an image data array, as evidenced in Hossack et al, ref 18. A property inherent to an array data structure is the index of each element of the array, typically used for selective access to a desired element, as well as the bounds of the numeric value of the index usually described by one skilled in the art as the "length" of the array. The length of the array is stored in memory and used to ensure that access to the images do not extend beyond the number of images stored in memory, and this length value represents the total number of two-dimensional images taken. One skilled

in the art would use an image data array as the method of data storage because it provides quick access to any given image.

Quistgaard and Vining do not disclose the remaining limitations set forth in claim 4.

Fenster '473 teaches the storage of an address pointer of the location of the images (col 2, line 24), the horizontal and vertical voxel sizes (col 2, lines 27-32), and the width and height of each acquired image (col 2, line 26).

Hossack et al teaches the storage of the location of the axis of rotation with respect to each of the images (col 8, lines 3-6), the relative location of each acquired image to the transducer (col 5, lines 6-11), and the angular separation of each image (col 13, lines 3-8 and col 16, lines 20-23).

It would have been obvious to one of ordinary skill in the art at the time of the invention that the information taught by Fenster '473 and Hossack as described can be stored in a header file to each image, because such a practice was well known in the art. Fenster '473 teaches that this information can be used to allow a display module to interpret the acquired image data correctly (col 6, lines 19-23), and Hossack et al teaches that this information can be used in registering the respective image data frames appropriately in three-dimensions to form the desired three-dimensional representation (col 2, line 66).

15. In regards to **claim 9**, Fenster '473 further discloses the width and height of each acquired image as the number of pixels along the x and y axis of each two-dimensional image (col 2, line 26).

It would have been obvious to one of ordinary skill in the art at the time of the invention to store the total number of two-dimensional images taken as the total number of acquired

images because the total number of two-dimensional images taken is the maximal number of two-dimensional images the system would need access from the image data array. Quistgaard's system stores planar (two-dimensional) images (col 4, lines 20-21).

16. In regards to **claim 10**, Fenster '473 further discloses the horizontal and vertical voxel sizes as the physical distance between adjacent pixels (col 2, lines 28-30).

17. **Claim 6** is rejected under 35 U.S.C. 103(a) as being unpatentable over Quistgaard and Vining as applied to claim 1 above, and further in view of Fenster et al (U.S. Patent 5,842,473), and Hossack et al (U.S. Patent 6,360,027).

18. In regards to **claim 6**, Quistgaard and Vining do not teach the storage of the parameters as comprised in claims 6 and 7.

Fenster '473 teaches calibrating for the horizontal and vertical voxel sizes in col 6, lines 44-52.

Hossack et al teaches storing the location of the axis of rotation with respect to each of the images (col 8, lines 3-6).

It would have been obvious to one of ordinary skill in the art at the time of the invention to store this calibration information because it is used to interpret the image data correctly (Fenster '473, col 6, line 19-23).

19. **Claim 7** is rejected under 35 U.S.C. 103(a) as being unpatentable over Quistgaard, Vining, Fenster '473, and Hossack et al as applied to claim 6 above, and further in view of Fenster et al (U.S. Patent 5,454,371).

20. In regards to **claim 7**, Quistgaard, Vining, Fenster '473, and Hossack do not specifically disclose storing calibration data comprising the degree of out-of-plane tilt of the transducer, the degree of out-of-plane displacement, nor the degree of in-plane tilt.

Fenster '371 teaches of using said calibration data (col 8, lines 24-52) to compensate for inaccuracies in the final reconstructed three-dimensional image (col 8, lines 63-65). Once said data were known, it would have been obvious to one of ordinary skill in the art at the time of the invention to store said data as calibration data because they are constant for any set of image lines of an image array to be reconstructed (col 10, lines 23-38) and can be reused for such reconstruction without unnecessary recalculation.

21. **Claim 8** is rejected under 35 U.S.C. 103(a) as being unpatentable over Quistgaard and Vining as applied to claim 1 above, and further in view of Fenster et al (U.S. Patent 5,842,473), and Hossack et al (U.S. Patent 6,360,027).

22. In regards to **claim 8**, Quistgaard additionally discloses the storage of the total angle of acquisition (col 6, lines 35-54). Quistgaard anticipates the storage of a 90deg sector image (col 6, line 40). This storage of this value is necessary to estimate the amount of physical space the image represents as shown in Figure 3, and this value can be used to keep track of virtual viewpoint changes as shown in col 5, lines 20-43.

Quistgaard further discloses the storage of the total number of acquired images (col 4, lines 19-23). Quistgaard anticipates the typical storage of 100 to 200 images (col 6, line 20). A data structure used to store images commonly employed and known to one skilled in the art is an image data array, as evidenced in Hossack et al, ref 18. A property inherent to an array data

structure is the index of each element of the array, typically used for selective access to a desired element, as well as the bounds of the numeric value of the index usually described by one skilled in the art as the "length" of the array. The length of the array is stored in memory and used to ensure that access to the images do not extend beyond the number of images stored in memory, and this length value represents the total number of acquired images. One skilled in the art would use an image data array as the method of data storage because it provides quick access to any given image.

Fenster '473 teaches the storage of the width and height of each acquired image (col 2, lines 23-32).

Hossack et al teaches the storage of the relative location of each acquired image to the transducer (col 5, lines 6-11) and the angular separation of each image (col 13, lines 3-8 and col 16, lines 20-23).

It would have been obvious to one of ordinary skill in the art at the time of the invention that the information taught by Fenster '473 and Hossack as described can be stored in a header file or an associated information file to each image upon the acquisition of said image, because such a practice was well known in the art. Fenster '473 teaches that this information can be used to allow a display module to interpret the acquired image data correctly (col 6, lines 19-23), and Hossack et al teaches that this information can be used in registering the respective image data frames appropriately in three-dimensions to form the desired three-dimensional representation (col 2, line 66).

23. **Claims 11 and 12** are rejected under 35 U.S.C. 103(a) as being unpatentable over Quistgaard and Vining as applied to claim 1 above, and further in view of Yamazaki et al (U.S. Patent 5,497,776).

24. In regards to **claim 11**, Quistgaard and Vining do not expressly disclose a means to generate a reverse map.

The specification defines a reverse map as a look-up table or partial look-up table used to determine the location within the succession of two-dimensional image slices of the particular pixels which must be retrieved from memory to produce the display image selected by the user (p 11, line 30).

Yamazaki et al teaches the display of side planes (col 11, line 18) where the side planes displayed are determined by the position of cross section lines set by the user (col 11, line 1). The reference reads on the claim because in each case, a method of selecting pixels from the stored images relies on an input (look-up table or cross section lines) to determine which pixels should be selected for display. In other words, the cross section lines determine which pixels to be displayed from the stored images in the same manner the look-up table determines which pixels to display for the present invention. Thus, the reference performs the same function as the claim.

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the transformation means of Yamazaki et al with the system of Quistgaard because Quistgaard's system displays only the three-dimensional image while Yamazaki's transformation means can display the three-dimensional image and a base plane on one screen (Fig 5a).

25. In regards to **claim 12**, Quistgaard and Vining do not expressly disclose the reverse map enclosing edges of the images nor an orientation in a plane orthogonal to the planes of the images.

Yamazaki further teaches his transformation means incorporates the edges of the acquired images (Fig 4) and displaying an orientation orthogonal to the planes of the images (Fig 4 and col 11, line 19).

Conclusion

26. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher T. Sukhaphadhana whose telephone number is (703) 306-4148. The examiner can normally be reached on 9a-5p M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh M. Mehta can be reached on (703) 308-5246. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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